



**Western Administrative Support Center
National Oceanic and Atmospheric Administration
Seattle, Washington**

OUTLINE SPECIFICATION

for

PROPOSED NMFS HONOLULU LABORATORY RENEWAL PROJECT



FINAL SUBMITTAL
June 7, 1999

Prepared by:

 **SUMMIT TECHNOLOGY**
CONSULTING ENGINEERS, INC., P.S.
615 Second Avenue, Suite 580
Seattle, WA 98104

In Association with:

- **MWM Architects, Inc.**
- **Ferraro Choi & Associates, Ltd.**
Architecture
- **Lincolne Scott & Kohloss, Inc.**
Consulting Engineers



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DIVISION 02 - SITE WORK

Section 02050 - Demolition

- A. Includes site demolition of two metal buildings, concrete slabs, and concrete foundations; and demolition of building interior and mechanical and electrical systems.
 - 1. Protection of existing facilities.
 - 2. Dust control.
 - 3. Material disposal.
 - 4. Minimum interference with streets and sidewalks.

Section 02110 - Clearing and Grubbing

- A. Includes clearing sod, soil, trees, and stumps from the site.
- B. Disposal of unsuitable or excess materials resulting from the clearing operation.
- C. Environmental protection.

Section 02210 - Grading

- A. Includes excavation and fill required to attain finish grades, preparation of subgrade for pavement, walkways, concrete slabs, and planted areas.
- B. Compaction as a percentage of maximum density will be 95 percent under pavement, walkways, and concrete slabs; 90 percent under planted or unpaved areas, per ASTM D1557.
- C. Satisfactory and unsatisfactory soil materials will be as defined by ASTM D2487.

Section 02221 - Excavation, Filling, and Backfilling for Buildings

- A. Compaction as a percentage of maximum density will be 95 percent under building foundations, slabs, and pier footings, per ASTM D1557.
- B. Satisfactory and unsatisfactory soil materials will be as defined by ASTM D2487.
- C. Rock excavation is indicated by the Geotechnical Report.

Section 02222 - Excavation, Trenching, and Backfilling for Utilities Systems

- A. Includes earthwork for utilities systems, to points of connection 1.52 m [5 ft.] outside of buildings.
- B. Specifications for soil and rock excavation, as indicated by the Geotechnical Report.
- C. Compaction specification and definition of soil materials, per ASTM D1557 and D2487.

Section 02241 - Aggregate Base

- A. Specification of crushed rock materials and compaction for bituminous pavement base course.

Section 02400 - Planting Soil Preparation and Soil Mixes

- A. Specification of planting soil mix and preparation for landscaping.

Section 02480 - Seeding

- A. Specification of types of fertilizer and seed mixes to be used.

Section 02511 - Concrete Sidewalks

- B. Includes surface preparation, form construction, concrete placement, joints, finishing, and curing.
- C. Specification of concrete materials and joint filler materials for 101.6-mm [4-in.]-thick sidewalks.

Section 02551 - Bituminous Paving for Roads

- A. Includes access roads and parking areas.
- B. Specification of asphalt-aggregate mixture, per HIDOT standards.
- C. Includes placing of mix on prepared surface; joints, rolling, and quality control.
- D. Materials and installation per applicable HIDOT, ASTM, and AASHTO standards.

Section 02558 - Bituminous Tack Coat

- A. Specification of materials and rate and method of application.

Section 02559 - Bituminous Prime Coat

- A. Specification of materials, rate and method of application, and curing and drying.

Section 02580 - Pavement Markings

- A. Includes markings for parking spaces, striping, walkways, and disabled persons' parking areas.
- B. Specifications of products, colors, and application of paint.

Section 02660 - Water Lines

- A. Includes system performance requirements, products, installation, and quality control.
- B. Specification of pipe, fittings, valves, and underground warning tapes. Water services piping ductile iron per AWWA C151, or copper per ASTM B88.
- C. Specification for system installation, disinfecting, and pressure and bacteriological testing.
- D. Special provisions for pipe transporting fish.
- E. Coordination with City and County of Honolulu Board of Water Supply, Water Service Engineering.

Section 02720 - Storm Drainage Systems

- A. Includes storm-drainage catch basins, piping, and appurtenances from points of connection 1.52 m [5 ft.] outside buildings to the point of disposal.
- B. Specification of pipe, fittings, catch basins, manholes, and underground warning tape. PVC pipe per ASTM D3034, SDR 35.
- C. Specification for system installation and pressure testing.
- D. Coordination with City and County of Honolulu Board of Water Supply, Stormwater Quality.

Section 02730 - Sanitary Sewers

- A. Includes precast concrete vaults, manholes, and distribution boxes; piping and appurtenances from the point of connection 1.52 m [5 ft.] outside the building to the point of disposal.
- B. Specification for tightline pipe and underground warning tape. PVC pipe per ASTM D3034, SDR 35.
- C. Specification for system installation and pressure testing.
- D. Coordination with City and County of Honolulu Board of Water Supply, Wastewater Management.

Section 02800 - Site Improvements and Amenities

Section 02810 - Irrigation System

- A. Includes piped underground systems with piping, sprinkler heads, valves and controls.

Section 02820 - Fences and Gates

- A. Includes fences for protective, security, decorative and right-of-way purposes; gate operators.

Section 02831 - Chain-link Fence

- A. Includes general security fencing, gates, and appurtenances.
- B. Specification of fabric, posts, rails, locks, and accessories.
- C. Specification for installation and quality control.

Section 02840 - Walk, Road and Parking Appurtenances

- A. Includes parking bumpers, traffic barriers.

Section 02870 - Site Furnishings

- A. Includes site furniture and fixtures; e.g., bicycle racks, prefabricated planters, seating and table, trash and litter receptors.

Section 02900 - Planting

- A. Includes planting and transplanting of trees, shrubs, vines, and other herbaceous plants; temporary storage, layout, bed preparation, preparation of pits, pruning, plants, fertilizing, and backfilling; wrapping, staking and guying, protection, edging, and maintenance.

DIVISION 03 - CONCRETE

Section 03100 - Structural Concrete Formwork

- A. Rough Form Finish Surfaces: Of known structural properties, of sufficient strength and stiffness to hold concrete properly in place; shall prevent leakage of mortar.
 - 1. Smooth Form Finish Surfaces: Minimum 19.05-mm [0.75-in.]-thick, Plyform Class I, 7-ply, B-B Exterior Type, edge-sealed; conforming to PS-1.
- B. Form Accessories
 - 1. Form ties.
 - 2. Chamfer strips.
 - 3. Form release agent.
 - 4. Curing compound.
 - 5. Expansion joint filler.
 - 6. Expansion joint sealant.

Section 03200 - Concrete Reinforcement

- A. General Requirements
 - 1. Concrete Reinforcement work shall conform to the following standards:
 - a. American Society for Testing and Materials (ASTM), A 185, A 615, and A 706.
 - b. Standards of the Concrete Reinforcing Steel Institute (CRSI).
- B. Bar Reinforcement
 - 1. ASTM A 615, Grade 60, deformed.
- C. Welded Reinforcement
 - 1. ASTM A 706.
- D. Welded Wire Fabric
 - 1. ASTM A185.
- E. Tie Wire
 - 1. Black annealed wire.
 - 2. Gauge: 16.5 or heavier.
- F. Bar Supports
 - 1. Typical: CRSI Class 2 wire supports.

2. Supports Placed against Ground: Precast concrete blocks.
3. Surfaces Exposed to Weather and at Architectural Concrete: CRSI Class 1 plastic protected.
4. Where Support Is Not Closer to Concrete Surface than 12.7 mm [0.5 in.]: CRSI Class 3 wire supports.

Section 03300 - Cast-in-Place Concrete

A. General Requirements

1. Cast-in-place Concrete work shall conform to the following standards:
 - a. American Concrete Institute (ACI), ACI 301.
 - b. American Society for Testing and Materials (ASTM), C 33 and C 150.

B. Superstructure

1. Superstructure shall consist of 254-mm [10-in.], reinforced shear walls, reinforced concrete columns, and composite concrete slab with steel girder floor and roof system.

C. Concrete Work

1. Concrete work shall conform to requirements of ACI 301 as a minimum standard.

D. Cements and Aggregates

1. Cements and aggregates for exposed concrete shall be from constant sources throughout the Work.

E. Cement

1. ASTM C 150.

F. Aggregates

1. ASTM C 33.

G. Water

1. Water shall be clean, potable, and not detrimental to concrete.

H. Concrete Accessories

1. Granular base.
2. Vapor retarder as specified in Section 07190.
3. Sand fill over vapor retarder.
4. Curing materials.
5. Slat treatments.
6. Nonshrink grout.

DIVISION 04 - MASONRY

Section 04220 - Concrete Unit Masonry

A. General Requirements

1. Unit Masonry work shall conform to the following standards:
 - a. American National Standards Institute (ANSI), A41.1 and A41.2.
 - b. American Society for Testing and Materials (ASTM), A 625, C 90, C 129, C 145, and C 270.
 - c. Standards of the Brick Institute of America (BOA).
 - d. National Concrete Masonry Association (NCMA), "Standard Specification for Design and Construction of Load Bearing Concrete Masonry."

B. Concrete Masonry Units

1. Units shall be 101.6, 152.4, 203.2, and 304.8 mm [4, 6, 8, and 12 in.] by 406.4 mm [16 in.] nominal face dimension.
2. Units shall conform to ASTM C 90, ASTM C 129, and ASTM C 145, as applicable. Units shall be Grade N-1.

C. Mortar

1. Mortar shall conform to ASTM C 270, Type N.

D. Masonry Reinforcement and Accessories

1. Hot-dipped galvanized type.
2. In conformance with BIA and NCMA standards.

E. Masonry Anchors

1. Masonry anchors for cavity wall construction shall be Dur-O-Wal Rectangular Adjustable Ties (eye-and-pintle type), hot-dip galvanized.

F. Reinforcing

1. Reinforcing for vertically reinforced masonry shall conform to ASTM A 615, Grade 60.

DIVISION 05 - METALS

Section 05100 - Structural Steel

A. General Requirements

1. Structural steel work shall conform to the following standards:
 - a. American Society for Testing and Materials (ASTM), A 36 and A 307.
 - b. Standards of the American Welding Society (AWS).
 - c. Steel Structures Painting Council (SSPC), SSPC-Paint 1.

B. Components

1. Structural steel shapes, plates, and bars shall conform to ASTM A 36, unless otherwise noted on Plans.
2. Anchor bolts shall conform to ASTM A 307.
3. Electrodes for welding shall conform with provisions of the AWS Code.
4. Structural steel primer paint shall be fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

Section 05310 - Steel Deck

A. General Requirements

1. Steel Deck work shall conform to the following standards:
 - a. American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members."
 - b. American Institute of Steel Construction, specifications for Shear Connector dimensions.
 - c. American Society for Testing and Materials (ASTM), A 36, A 108, A 446, A 525, A 526, A 780, and G 60.
 - d. Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks, and Roof Decks."

B. Section Includes

1. Steel Deck Units for floor and roof applications.

C. Materials

1. Steel for Galvanized Metal Deck Units: ASTM A 446, grade as required to comply with SDI specifications. Size and gauge as indicated.
2. Miscellaneous Steel Shapes: ASTM A 36.

3. Shear Connectors: Headed stud type, ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel, with dimensions complying with AISC specifications.
4. Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.
5. Galvanizing: ASTM A 525, ASTM G 60.
6. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.
7. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

Section 05510 - Metal Stairs and Ladders

- A. Includes preassembled stairs, catwalks and ladders.

Section 05520 - Handrails and Railings

- A. Includes metal handrails and railings.

Section 05800 - Expansion Control

- A. Includes manufactured expansion joint assemblies, including frames, covers and gaskets.

DIVISION 06 - WOOD AND PLASTICS

Section 06200 - Finish Carpentry

- A. Includes standard pattern wood trim, prefinished standard hardboard paneling, wood components used for shelving.

Section 06400 - Architectural Woodwork

- A. Includes custom wood, laminate-clad, and simulated wood fabrications, including custom fabricated cabinets, cases and fixtures; plastic, metal, wood, and laminate-clad countertops; custom standing and running trim.

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

Section 07100 - Dampproofing and Waterproofing

Section 07130 - Sheet Waterproofing

- A. Includes waterproofing formed with sheets of elastomeric, bituminous, modified bituminous, or thermoplastic materials.

Section 07210 - Building Insulation

- A. Includes organic and inorganic insulation applied for thermal protection in walls, ceilings, attics, and crawl spaces.

Section 07240 - Exterior Insulation and Finish Systems (EIFS)

- A. Includes both polymer-based and polymer-modified coating and finish applied at site or in shop directly to foam insulation base or directly to other compatible substrate.

Section 07500 - Membrane Roofing

- A. Includes roofing assemblies applied to the structural substrate, over insulation, or protected with insulation as appropriate to the particular assembly; includes composition and elastomeric flashing; surfacing materials, coatings, and ballast; maintenance programs and maintenance and repairs to membrane roofing assemblies.

Section 07600 - Flashing and Sheet Metals

- A. Includes copper roofing, accessories and trim, and specialties associated with roofing, and copper and other flexible flashings for roofing and wall construction.

Section 07700 - Roof Specialties and Accessories

- A. Includes standard manufactured components, both formed or extruded; includes manufactured roof specialties; e.g., copings counterflashing systems, gutters and downspouts, scuppers; includes accessories installed on or in roofing other than mechanical or structural items; e.g., roof hatches, vents, roof curbs.

Section 07900 - Joint Sealers

- A. Includes preformed joint seals, sealants, calking components, and related accessories.

DIVISION 08 - DOORS AND WINDOWS

Section 08100 - Metal Doors and Frames

- A. Includes standard and custom metal doors and fixed panels; includes steel, stainless steel, and aluminum doors and frames; preassembled metal door and frame units.

Section 08200 - Wood and Plastic Doors

- A. Includes hinged or pivoting doors and fixed panels; solid core; fire-rated and non-fire-rated doors; includes preassembled wood door and frame units.

Section 08300 - Specialty Doors

- A. Includes doors and door assemblies for special functions and applications; e.g., access door and panels in walls and ceilings; coiling doors and grilles; folding doors and grilles; overhead doors.

Section 08400 - Entrances and Storefronts

- A. Includes one-story entrances and storefronts fabricated from formed and extruded metals and glass components for exterior and interior applications; includes factory glazing; includes hardware supplied as an integral component to the entrance and storefront.

Section 08520 - Aluminum Windows

- A. Includes aluminum windows, fixed and operable, operating hardware, screens and other accessories.

Section 08580 - Special Function Windows

- A. Includes intended for specialized application; e.g., sound control windows.

Section 08700 - Hardware

- A. Includes hardware and gaskets for doors and windows not specifically supplied as part of the manufactured items; includes electronic, magnetic, and other systems for operating, controlling, and monitoring doors and windows.

Section 08800 - Glazing

- A. Includes glass, plastic glass, and glazing accessories; includes glazing used for doors, windows, sidelights, transoms, entrances, curtain walls, and framed skylights.

Section 08900 - Glazed Curtain Wall

- A. Includes standard and custom fabricated curtain walls consisting of framing members, sash, glazing, spandrel and infill panels, fasteners, and sealants installed as an integrated assembly to enclose vertical or sloped surfaces; includes insulated metal infill panels, other infill panels and louvers that are an integral part of the curtain wall system.

DIVISION 09 - FINISHES

Section 09100 - Metal Support Assemblies

- A. Includes metal framing systems, ceiling suspension systems, and furring systems.

Section 09200 - Plaster and Gypsum Board

- A. Includes exterior and interior veneer plaster, and acoustical plaster; includes exterior and interior gypsum board, gypsum board assemblies, accessories and trim.

Section 09300 - Tile

- A. Includes manufactured surfacing units of impervious, vitreous, semi-vitreous, and non-vitreous materials; glazed, unglazed, conductive, abrasive and textured surfaces; e.g., ceramic tile; quarry tile.

Section 09500 - Ceilings

- A. Includes ceiling panels, units, and materials manufactures as finished ceiling surfaces; e.g., acoustical ceiling tiles and panels.

Section 09600 - Flooring

- A. Includes finished flooring primarily intended for interior locations, set over independent structural support; includes coatings and surfacing; e.g., slip-resistant floor treatment, static-resistant floor treatment; resilient flooring; e.g., resilient tile and sheet flooring, resilient base; static control flooring; fluid-applied flooring; e.g., elastomeric liquid flooring; carpet, including carpet materials, carpet cushions and accessories.

Section 09700 - Wall Finishes

- A. Includes wall finishes applied over solid substrates, includes acoustical wall finishes; includes wall coverings; e.g., vinyl wall covering.

Section 09800 - Acoustical Treatment

- A. Includes acoustical sound absorbing wall and ceiling units, acoustical barriers and acoustical insulation.

Section 09900 - Paints and Coatings

- A. Includes stains, transparent finishes, special coatings, varnishes, lacquers, primers, fillers, paint removers, waxes and preparation of surfaces; includes paints; e.g., interior and exterior paints; includes stains and transparent finishes; includes high-performance coatings; e.g., glazed resinous coatings, interior and exterior cementitious coatings.

DIVISION 10 - SPECIALTIES

Section 10100 - Visual Display Boards

- A. Includes chalkboard, markerboards, and visual aid boards; framing systems and accessories. Includes rail-mounting devices for display boards; manual and motor-operated units with integral projection screens.

Section 10115 - Markerboards

- A. Includes markerboards made from porcelain-enameled steel and aluminum. Includes markerboards with integral photocopy units and electronic interface with computers.

Section 10120 - Tackboard and Visual Aid Boards

- A. Includes bulletin boards with mounting surfaces of cork, composition board, and fabric-covered material.

Section 10150 - Compartments and Cubicles

- A. Includes compartments and cubicles that are enclosures, dividers, screens and curtains for toilets, urinals, showers, dressing compartments; includes hardware and accessories.

Section 10200 - Louvers and Vents

- A. Includes items and enclosures for ventilation that are not an integral part of mechanical equipment. Includes plastic and metal wall louvers. Includes louvered equipment enclosures. Includes non-rated door louvers. Includes soffit and wall vents in plastic and metal.

Section 10240 - Grilles and Screens

- A. Includes exterior and interior grilles and screens of wood, metal, plastic, and other materials used for a variety of functions and not limited to ventilation purposes.

Section 10260 - Wall and Corner Guards

- A. Includes protective devices such as corner guards, bumper rails, and guards for wall surfaces, made of metal, plastic, rubber, and other finish materials.

Section 10270 - Access Flooring

- A. Includes free-standing, accessible floor assembly of modular panels and elevated support systems forming an underfloor cavity for mechanical and electrical services distribution. Includes air outlets and inlets integral with floor panels.

Section 10290 - Pest Control

- A. Bird, insect, and rodent control. Includes mechanical, electrical and physical repellant systems and protective devices.

Section 10350 - Flagpoles

- A. Includes complete flagpole fabrications of metal, wood, and fiberglass, including all accessories and appurtenances.

Section 10400 - Identification Devices

- A. Includes directories, directional items, letters, signs, and plaques of various materials used in establishing identity or communication.

Section 10500 - Lockers

- A. Includes storage facilities providing temporary security of contents, related hardware and locking devices; athletic lockers, and tenant lockers.

Section 10520 - Fire Protection Specialties

- A. Includes fire extinguishers, extinguisher cabinets and accessories; does not include devices connected to a fire protection system.

Section 10600 - Partitions

- A. Includes operable panels and partitions, auditorium partitions and dividers. Includes partitions fabricated of wire mesh. Includes track-mounted operable panels and partitions, top-hung and floor supported, manually and motor-operated.

Section 10670 - Storage Shelving

- A. Includes open, manufactured shelving for general storage. Includes manual and motorized mobile and compact storage systems.

Section 10750 - Telephone Specialties

- A. Includes manufactured telephone enclosures, stalls, booths and alcoves for installation of telephones.

Section 10800 - Toilet Accessories

- A. Includes grab bars, towel dispensers, towel disposal units, soap dispensers, deodorizers, sanitary napkin dispensers, toilet paper dispensers, tampon dispensers, sanitary napkin disposal units, waste disposal units, robe hooks, metal-framed mirrors, air hand dryers, and other toilet accessories.

DIVISION 11 - EQUIPMENT

Section 11010 - Maintenance Equipment

- A. Includes prefabricated, built-in, and field assembled equipment for building maintenance.

Section 11050 - Library Equipment

- A. Includes book depositories, library stack systems, and other equipment related to libraries. See 10670 for mobile and compact storage units.

Section 11150 - Parking Control Equipment

- A. Includes parking gates, ticket dispensers, key and card control units, and related accessories.

Section 11450 - Residential Equipment

- A. Includes built-in or freestanding residential kitchen appliances.

Section 11600 - Laboratory Equipment

- A. Includes equipment for scientific use, service fittings and accessories, fume hoods, sterilizers, refrigerators, and emergency safety appliances. See 12350 for laboratory casework, tops and sinks, and service fixtures mounted on laboratory tops.

DIVISION 12 - FURNISHINGS

Section 12300 - Manufactured Casework

- A. Includes stock modular cabinets, and other casework units that are steel, wood, or plastic-laminate-faced; includes laboratory countertops with integral sinks and fixtures and accessories mounted on countertops; sinks integral with countertops, such as resin-type corrosion-resistant sinks.

Section 12490 - Window Treatments

- A. Includes window coverings, associated hardware and controls.

Section 12500 - Furniture

- A.

Section 12700 - Systems Furniture

- A.

DIVISION 13000 - SPECIAL CONSTRUCTION

Section 13700 - Security Access and Surveillance

- A. Includes security access, intrusion detection, alarm and security surveillance systems.

Section 13850 - Detection and Alarm

- A. Includes signaling equipment and automated fire, smoke, gas, and leak detection and warning systems.

Section 13900 - Fire Suppression

- A. Includes automated fire suppression and piped fire suppression systems, including pipe, fittings, valves, supports, pumps, specialties, and sprinklers.

DIVISION 14000 - CONVEYING SYSTEMS

Section 14200 - Elevators

- A. Includes passenger and freight elevators; includes cars, entrances, controls, safety equipment, hoistway equipment, and elevator machinery; e.g., electric traction elevators, including both freight and passenger types.

DIVISION 15 - MECHANICAL

Section 15050 - Basic Mechanical Materials

A. Project Includes

1. Basic mechanical materials including valves, pipe expansion joints, meters and gages, supports and anchors, motors, mechanical identification, and vibration control.

B. Products

1. Pipe, Fittings, and Specialties: Refer to individual piping systems specifications for materials and installation requirements.
2. Valves: General duty valves cast-iron, bronze, and brass, fabricated to comply with Manufacturers Standardization Society (MSS) classification listed. Gate, ball, and butterfly valves for shutoff duty; ball, and butterfly valves for throttling duty.
 - a. Gate Valves, 65 mm [2.5 in.] and larger: MSS SP-70, Class 125, iron body, flanged ends.
 - b. Ball Valves, up to 50 mm[2 in.]: Rated for 1035 kPa [150 psi] saturated steam pressure, 400 WOG pressure, bronze body, threaded or solder ends based on service.
 - c. Butterfly Valves, 65 mm [2.5 in.] and Larger: MSS SP-67, rated at 1070 kPa [200 psi], cast-iron body, field-replaceable sleeve, stainless steel stem, lug or wafer type based on service.
 - d. Swing Check Valves, 50 mm [2 in.] and Smaller: MSS SP-80, Class 125 or 150 based on system pressure, cast-iron body and cap, threaded or solder ends based on service.
 - e. Swing Check Valves, 65 mm [2.5 in.] and Larger: MSS SP-71, Class 125, cast-iron body and cap, flanged ends.
 - f. Wafer Check Valves: Class 250, cast-iron body, to open with 3 kPa (one foot) differential pressure.
3. Meters and Gages: Temperature and indicator ranges for services required. Accuracy of thermometers plus or minus 1 percent.
4. Test Plugs: Nickel-plated brass body, self-sealing valve-type core inserts.
5. Supports and Anchors—Hangers and Support Components: MSS SP-58, pipe and equipment hangers and supports including clamps, hanger-rod attachments, saddles and shields, spring hangers, pipe alignment guides, and anchors.
6. Motors: NEMA MG 1 motors with phase, frequency rating, voltage rating, and capacity suitable for use.
7. Mechanical Identification: ASME A13.1 as applicable, color coded, of the following types: Standard stencils, pressure-sensitive pipe markers, valve tags, valve tag fasteners, access panel markers, valve schedule frames, engraved plastic laminate signs, plastic equipment markers, all as suitable for use.

8. Vibration Control: Neoprene pads, vibration isolation springs, all-directional anchors, neoprene mountings, free-standing spring isolators, housed spring isolators, vertically-restrained spring isolators, earthquake-resistant spring isolators, seismic snubbers, thrust restraints, equipment rails, fabricated equipment bases, roof-curb isolators, isolation hangers, riser isolators, flexible pipe connectors suitable for use.

Section 15250 - Mechanical Insulation

A. Project Includes

1. Pipe insulation, equipment insulation, and external duct and plenum insulation.

B. Products

1. Mechanical Insulation Types:
 - a. Pipe Insulation: Rigid cellular glass, elastomeric cellular types.
 - b. Equipment Insulation: Glass fiber, flexible elastomeric cellular types.
 - c. Duct and Plenum Insulation: Glass fiber.
2. Mechanical Insulation Materials:
 - a. Cellular Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible, ASTM C 921, Type I facing; blocks, ASTM C 552, Type I; boards, ASTM C 552, Type IV; preformed pipe, ASTM C 552, Type II, Class 2 (jacketed); special shapes, ASTM C 552, Type III.
 - b. Flexible Elastomeric Cellular Insulation: Flexible expanded closed-cell structure with smooth skin on both sides; tubular materials, ASTM C 534, Type I; sheet materials, ASTM C 534, Type II.
 - c. Fire Performance: Type suitable for service.
 - d. Vapor Barrier: Type suitable for service.
 - e. Insulation Accessories: Insulating cements, adhesives, jackets, glass cloth and tape, bands, wire, and sealing compounds suitable for service and exposure.

Section 15320 - Fire Pumps

A. Project Includes

1. Fire pumps and pressure maintenance pumps to supply water for fire protection systems.

B. Quality Assurance

1. Compliance: ASME B31.9 for piping; NFPA 20 for centrifugal fire pumps.

C. Products

1. Fire Pump System Components:

- a. Fire Pumps, General: UL 448, base-mounted, factory-assembled, factory-tested.
 - b. Axially-Split-Case Fire Pumps: Centrifugal, separately coupled, bronze-fitted, labeled for fire service, horizontally mounted, single-stage type.
2. Fire Pump System Motors and Controllers:
 - a. Electric Motors: Open drip-proof, squirrel cage, induction motor type, NFPA 20 and NFPA 70, suitable for type of fire pump.
 - b. Full-Service, Electric-motor-drive Fire Pump Controllers: Combined automatic and nonautomatic operation, UL listed and FM approved, UL 508, UL 1008, type suitable for use.
3. Fire Pump System Accessories:
 - a. Alarm Panels: NEMA ICS 6, Type 1 remote wall-mounting-type.
 - b. Horizontal Fire Pump Accessory Fittings: Automatic air release valve, casing relief valve, suction and discharge pressure gages, reducers, hose valves, discharge cone.
 - c. Flow Measuring Systems: FM-approved with sensing element and flow meter.
4. Pressure Maintenance Pump:
 - a. Pump: Base-mounted, factory-assembled, factory-tested, vertical turbine pressure maintenance pump.
 - b. Controllers: Combined automatic and nonautomatic operation, UL listed, UL 508, NEMA ICS 6, Type 2, wall-mounted enclosure.
 - c. Accessories: Casing relief valve, suction and discharge pressure gages.

Section 15325 - Standpipe and Sprinkler Systems

A. Project Includes

1. Sprinkler System:
 - a. Wet pipe system with automatic sprinklers.
 - b. Preaction system with automatic sprinklers.
2. Standpipe and Hose System:
 - a. Dry, without permanent water supply.
 - b. NFPA 14 Class I classification for use by trained personnel.

B. Quality Assurance

1. Compliance: NFPA 13 for sprinkler system, NFPA 14 for standpipes; UL-listed and labeled; FM-approved.
2. Calculations: Hydraulic calculations for pipe sizing by Contractor.

C. Products

1. Pipes and Fittings:
 - a. Ductile Iron Pipe: AWWA C115, ductile-iron barrel with iron-alloy threaded flanges.
 - b. Steel Pipe: ASTM A 53, Schedule 40 in sizes 150 mm [6 in.] and smaller, Schedule 30 in size 200 mm [8 in.] and larger, black and galvanized.
 - c. Steel Pipe: ASTM A 135, Schedule 10 through 125 mm [5 in.] and NFPA 13 wall thickness for 150 mm [6 in.] through 250 mm [10 in.], plain ends, black and galvanized.
 - d. Steel Pipe: ASTM A 135, threadable lightwall, black and galvanized.
 - e. Steel Pipe: ASTM A 795, black and galvanized for plain end steel pipe.
 - f. Fittings: Suitable for service class and piping type; threaded, grooved-end, press-seal types.
 - g. Joining Materials: Welding and gasket materials suitable for design temperatures and pressures. Grooved couplings.
2. Valves and Accessories:
 - a. General Duty Valves: Gate valves, swing check valves.
 - b. Specialty Valves: Alarm check valves, dry-pipe valves, deluge valves, detector check valves suitable for system use.
 - c. Manual Control Stations: Hydraulic operation, with union, pipe nipple, and bronze ball valve.
 - d. Control Panels: Single-area, two-area, or single-area cross-zoned as required, NEMA ICS 6 Type 1 enclosure.
 - e. Backflow Preventers: ASSE, sized for maximum flow rate and maximum pressure loss.
 - f. Fire Department Connections: UL 405, [flush, wall type] [exposed, wall type] [exposed, sidewalk type] unit, connections and finish suitable for use.
 - g. Alarm Devices: Water-motor-operated alarms, waterflow indicators, pressure switches, supervisory switches.
 - h. Pressure Gages: UL 393.
3. Sprinklers, Hose Racks and Accessories:
 - a. Automatic Sprinklers: Fusible link type; upright, pendant, and sidewall styles; concealed, flush, and recessed styles; wall-mounted sprinkler head cabinet and wrench, suitable for service required.
 - b. Sprinkler Fittings: UL-listed and FM-approved, UL 213.
 - c. Nonadjustable Hose Valves: UL 668.

Section 15410 - Plumbing Piping and Specialties

A. Project Includes

1. Plumbing piping systems within the building including the following:
 - a. Potable water distribution, including cold and hot water supply and hot water circulation.
 - b. Drainage and vent systems, including sanitary and storm.
2. Plumbing specialties for water distribution systems; soil, waste, and vent systems; and storm drainage systems.

B. Quality Assurance

1. Compliance: ASME B31.9.

C. Products

1. Piping System Working Pressure Ratings:
 - a. Water Distribution Systems, Below Ground: 1035 kPa [150 psig].
 - b. Water Distribution Systems, Above Ground: 860 kPa [125 psig].
 - c. Soil, Waste, and Vent Systems: 30 kPa (10 foot) head of water.
 - d. Storm Drainage Systems: 30 kPa (10 foot) head of water.
 - e. Sanitary Sewage, Pumped Piping Systems: 510 kPa [75 psig].
2. Pipes and Tubes:
 - a. Hard Copper Tube: ASTM B 88, Type L, water tube, hard drawn.
 - b. Hubless, Cast-iron Soil Pipe: CISPI 301.
3. Fittings and Valves:
 - a. Pressure and Drainage Fittings for Pipe and Tubes: Suitable for working pressure, pipe, tube, and service.
 - b. Joining Materials: Solder, brazing and welding filler metals; couplings.
 - c. Valves: Gate, ball, butterfly, and check valves suitable for service.
4. Plumbing Specialties:
 - a. Backflow Preventers: Reduced pressure backflow preventers for flow rate and maximum pressure loss required, 1035 kPa [150 psig] minimum working pressure.
 - b. Water-pressure Regulators: Initial working pressure 1035 kPa [150 psig] minimum.
 - c. Water Filters: Cartridge-type with housing, fittings, cartridges, end caps, suitable for potable water.
 - d. Thermostatic Water-mixing Valves: Manually adjustable.
 - e. Miscellaneous Piping Specialties: Strainers, hose bibbs, wall hydrants, post hydrants, sanitary hydrants, hose-end drain valves, stop and waste drain valves; water hammer

arrestors, trap seal primer valves, stack flashing fittings, vent caps, vent terminals, roof flashing assemblies.

- f. Cleanouts: Cast-iron cleanouts, ASME A112.36.2M.
- g. Floor Drains: Cast-iron floor drains, ASME A112.21.1M;
- h. Roof Drains: Cast-iron body, ASME A112.21.2M with combination flashing ring and gravel stop.
- i. Sleeve Penetration Systems: UL 1479, through-penetration firestop assembly.

Section 15440 - Plumbing Fixtures

A. Project Includes

- 1. Plumbing fixtures and trim, fittings, and related accessories and appliances.

B. Quality Assurance

- 1. Compliance: ANSI A117.1; Applicable accessibility regulations.

C. Products

- 1. Plumbing Fixtures:
 - a. Water Closets: Vitreous china, elongated bowl type, flushometer type, trim suitable for service required.
 - b. Urinals: Vitreous china, wall hanging type, flushometer, trim suitable for service required.
 - c. Lavatories: Countertop or wall mounted, fittings and accessories suitable for service required.
 - d. Sinks: Material, type, fittings and accessories suitable for service required.
 - e. Water Coolers: ARI 100, type, capacity, and fittings suitable for service required.
 - f. Emergency Equipment: Eyewash and shower stations.
 - g. Flushometers: Water closet and urinal types.
 - h. Commercial Faucets: Cast-brass faucets.
 - i. Sensor-operated Faucets and Devices: Automatic operating units.
 - j. Fittings, Except Faucets: Supplies, stops, traps, continuous wastes, and escutcheons.
 - k. Supports: ASME A112.6.1M, categories and types as required for fixtures required, including wall reinforcement.

Section 15450 - Plumbing Equipment

A. Project Includes

1. Commercial water heaters for potable water heat systems.
- B. Quality Assurance
 1. Compliance, Water Heaters: UL 174, 732, 778, 1261, 1453; NSF 5; ASME Code Compliance.
- C. Products
 1. Water Heaters:
 - a. Gas-fired, Copper, Finned-tube Water Heaters: Packaged automatic 1100-kPa [160-psig]-rated finned-tube heat exchanger with controls, draft diverter, burner, gas train, and circulating pump.
 - b. Electric Heat Pump: stainless steel casing, hermetic compressor (R134a) and circulating pump.
 - c. Accessories: Valves, gages, and concrete base.

Section 15488 - Natural Gas Systems

- A. Project Includes
 1. Synthetic natural gas systems within the building.
- B. Quality Assurance
 1. Compliance: NFPA 54.
- C. Products
 1. Piping System Working Pressure:
 - a. Low-pressure Synthetic Natural Gas Piping Systems: 14 kPa [2 psig].
 2. Pipe, Fittings, and Specialties:
 - a. Steel Pipe and Tubes: ASTM A 53, Type E welded or Type S seamless, Grade B, Schedule 40, black.
 - b. Plastic Pipe: ASTM D 2513, polyethylene (PE), DR 11 or DR 11.5.
 - c. Fittings and Valves: Suitable for piping type and service class.
 - d. Gas Meter and Pressure Regulator: Provided by gas supplier; pressure regulator at device.
 - e. Piping Specialties: Flexible connectors, strainers.
 - f. Protective Coating: Corrosion-resistant polyethylene for use in corrosive atmosphere.

Section 15490 - Laboratory Systems

- A. Project Includes
 1. Laboratory Equipment, Pumps, Piping, and Accessories for the Following Applications:

- a. Reagent grade water systems.
 - b. Chemical waste and vent systems.
 - c. Laboratory compressed-air and vacuum systems.
- B. Quality Assurance
- 1. Compliance: NFPA 45, NFPA 99.
- C. Products
- 1. Pipe and Applications:
 - a. Reagent Grade Water Systems: Polypropylene plastic pipe, Schedule 80; polyvinylidene fluoride plastic pipe, Schedule 80; stainless steel tube; and compatible fittings.
 - b. Chemical Waste Systems—Below-ground Systems: High-silicon iron pipe; polypropylene plastic pipe, Schedule 40; polyvinylidene fluoride plastic pipe, Schedule 40; polyvinyl chloride plastic pipe; and compatible fittings.
 - c. Chemical Waste and Vent Systems—Above Ground: High-silicon iron pipe; polypropylene plastic pipe, Schedule 40; polypropylene plastic pipe, fire-retardant; polyvinylidene fluoride plastic pipe, Schedule 40; polyvinyl chloride plastic DWV pipe; and compatible fittings.
 - d. Chemical Waste Containment Piping: Polypropylene plastic containment pipe; polyvinylidene fluoride plastic containment pipe; and compatible fittings.
 - e. Laboratory Compressed-Air, Vacuum, Above Ground: Hard-drawn copper tube with suitable fittings.
 - 2. Laboratory System Components:
 - a. Valves: Reagent grade water valves, gas valves, and ball valves suitable for use.
 - 3. Laboratory System Accessories:
 - a. Strainers.
 - b. Neutralization tanks.
 - c. Dilution traps.
 - d. Drainline interceptor traps.
 - e. Corrosion-resistant traps.
 - f. Chemical-resistant floor drains.
 - g. Chemical-resistant cleanouts, backwater valves, and sink outlets.
 - h. Service outlets.
 - i. Pressure control panels.

Section 15510 - Hydronic Piping

A. Project Includes

1. Piping systems for chilled water cooling, condenser water, make-up water, and drain piping.

B. Quality Assurance

1. Compliance: ASME Code, ASME B 31.9.

C. Products

1. Pipes and Fittings:

- a. Copper Pipe and Tube Material: Hard-drawn copper tubing, ASTM B 88, Type L.
- b. Steel Pipe: ASTM A 53, Schedule 40, black steel pipe.
- c. Fittings: Suitable for piping type and service class.
- d. Joints: Solder, gaskets, grooved mechanical joints, press-seal fittings suitable for service.

2. Valves:

- a. General Duty Valves: Gate, check, ball, and butterfly valves suitable for use.
- b. Special Duty Valves: Pressure reducing valves, safety relief valves, combined pressure/temperature relief valves, and automatic flow control valves.

3. Specialties:

- a. Manual Air Vents: Bronze body, nonferrous internal parts.
- b. Diaphragm-type Compression Tanks: Suitable for working pressure and operating temperature, pressure tested.
- c. Chemical Feeder: Bypass type chemical feeder, welded steel construction.
- d. Y-Pattern and Basket Strainers: Cast-iron body, ASTM A 126, Class B.

Section 15540 - HVAC Pumps

A. Project Includes

1. Centrifugal pumps used in HVAC hydronic systems.

B. Quality Assurance

1. Compliance: UL 778; Hydraulic Institute Standards.

C. Products

1. HVAC Pumps and Accessories:

- a. Base-mounted, Flexible-coupled, End-suction Pumps: Centrifugal single-stage, cast-iron casings, balanced closed single-suction impeller, replaceable wear rings, steel pump shaft and sleeve bearings, mechanical seals, and four-pole motors.

Section 15680 - Chillers and Accessories

- A. Project Includes
 - 1. Chillers and accessories for use with air conditioning systems.
- B. Quality Assurance
 - 1. Compliance: ASHRAE 15, UL 465.
- C. Products
 - 1. Rotary Chillers:
 - a. Water-cooled Helical Rotary Chillers: Factory-assembled and tested compressors, condenser, evaporator, thermal expansion valve, unit controls, and heat recovery condensers; capacity suitable for use.

Section 15710 - Cooling Towers and Accessories

- A. Project Includes
 - 1. Cooling towers for rejecting condenser heat from water-cooled air-conditioning systems.
- B. Products
 - 1. Factory-fabricated Cooling Towers:
 - a. Induced Draft, Propeller Fan, Crossflow Cooling Towers: Factory-fabricated casings, collecting basin and sump, wetted-surface fill, drift eliminators, louvers, water distribution system, basin covers, discharge dampers, inlet screens, rails, ladders, water level control, flow control valves, fan drives, motors, and vibration cutout; low noise level; capacity suitable for use.

Section 15749 - Condenser Water Treatment System

- A. Project Includes
 - 1. Condenser water treatment system to inhibit scale, corrosion, and biological growth in open recirculating cooling water.
- B. Products
 - 1. Materials and Equipment:
 - a. Chemical Treatment Controller: Water flow meter, conductivity.
 - b. Chemical Solution Reservoir: High-density opaque polyethylene with internal floating suction assembly.
 - c. Condenser Water Sample Test Kit: Kit including case and spare reagents.
 - d. Chemicals: Recommended by condenser water treatment system manufacturer.
 - e. Filtration System: Sidestream filtration unit to remove suspended solids.

Section 15830 - Fan Coil Units

A. Project Includes

1. Fan coil units for cooling.

B. Products

1. Fan Coil Units:
 - a. Cooling Medium: Chilled water cooling.
 - b. Chassis: Galvanized steel with flanged edges.
 - c. Insulation: Faced; heavy-density glass fiber.
 - d. Cabinet: Steel; insulation over entire coil section.
 - e. Coils: Seamless copper tubes mechanically bonded to configured aluminum fins.
 - f. Drain Pans: Galvanized steel; insulated.
 - g. Fans: Centrifugal, forward-curved wheels.
 - h. Filters: Throwaway pleated type.

Section 15850 - Air-handling

A. Project Includes

1. Fans, air-handling units, and air filters for building mechanical systems.

B. Products

1. Centrifugal Fans:
 - a. Centrifugal Fans for Indoor Installations: Belt-driven; with housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
 - b. Inline Centrifugal Fans: Inline, belt-driven; with housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories.
2. Central Station Air-handling Units:
 - a. Constant-volume, Central Station Air-handling Units for Indoor Installations: ARI 430, NFPA 90A; blow-through type.
3. Air Filters:
 - a. Air Filters: ASHRAE 52, ARI 850, NFPA 90A, 90B.
 - b. Replaceable Throwaway Pleated Filters: Pleated panels, cardboard frame.
 - c. Extended Surface Non-supported-media Filters: Fibrous material with flexible internal supports, galvanized steel frame, and duct-holding frames.

- d. Filter Gages: Diaphragm type with suitable filter gage range, manometer type filter gage.

Section 15890 - Air Distribution

A. Project Includes

- 1. Air-distribution systems including ductwork, duct accessories, air outlets and inlets, and air terminals.

B. Quality Assurance

- 1. Compliance: NFPA 90A.

C. Products

- 1. Metal Ductwork:
 - a. Types: Rectangular, metal ducts and plenums for HVAC systems in pressure classes from minus 0.5 Pa [2 in.] to plus 2.5 Pa [10 in.] water gage.
 - b. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527 G90.
 - c. Stainless Steel: ASTM A 480, Type 316, with No. 4 finish if exposed, No. 1 finish for concealed ducts.
 - d. Duct Liner: NFPA 90A, TIMA AHC-101, ASTM C 1071, Type II with coated surface to prevent erosion of fibers.
 - e. Sealing Materials: Joint and seam sealants, tapes, and mastics.
 - f. Firestopping: Fire-resistant sealant.
 - g. Hangers and Supports: Concrete inserts, structural steel fasteners suitable for use; galvanized sheet steel hangers; duct attachments; trapeze and riser supports.
 - h. Fabrication: SMACNA HVAC Duct construction Standards.
- 2. Duct Accessories:
 - a. Backdraft Dampers: Galvanized steel frame, blades, blade seals, and axles.
 - b. Manual Volume Control Dampers: Galvanized steel, standard volume control dampers; galvanized steel jackshaft; damper control hardware.
 - c. Smoke Fire Dampers: UL 555 and UL 555S, galvanized steel frame, blades, and mounting sleeve; replaceable fusible link.
 - d. Actuators: Damper motors for smooth modulating or two-position action.
 - e. Duct Silencers: Factory-fabricated rectangular and round units; acoustic fill.
 - f. Turning Vanes: Manufactured and acoustic turning vanes.
 - g. Duct-mounted Access Doors and Panels:
 - h. Flexible Connectors: UL 181, Class 1, flame-retardant or noncombustible fabrics.

- i. Flexible Ducts: UL 181, Class 1, uninsulated and insulated types.
- j. Accessory Hardware: Instrument test holes, splitter damper accessories, flexible duct clamps, and adhesives.
- 3. Air Outlets and Inlets:
 - a. Ceiling Air Diffusers: Diffuser faces, mountings, patterns, dampers, accessories, and finishes suitable for service, use, and location.
 - b. Wall Registers and Grilles: Materials, faces, patterns, dampers, accessories, and finishes suitable for service, use, and location as selected.
- 4. Air Terminals:
 - a. Integral Diffuser Terminals: Galvanized, steel-lined plenum with extruded aluminum or sheet steel diffuser; with fixed or variable geometry; suitable for use.
 - b. Variable Air Volume Single Duct Terminals: Galvanized, steel plenum, acoustically lined, pressure-independent controls; suitable for use.

Section 15970 - HVAC Control Systems

A. Project Includes

- 1. Electric and electronic temperature-control systems used for building HVAC systems, direct digital control type, including stand-alone field controllers, central PC, graphical user interface, modem for remote monitoring, and printer.

B. Products

- 1. Electronic Control System Components:
 - a. Valves: Control valves, service valves, and terminal unit control valves.
 - b. Dampers: Automatic control dampers, frames, and damper and valve motors.
 - c. Thermostats: Room thermostats, remote-bulb thermostats, and fire protection thermostats.
 - d. Sensors: Electronic temperature sensors.
 - e. Control Panels: Local control panels and central control panels.

Section 15990 - Testing, Adjusting, and Balancing

A. Project Includes

- 1. Total testing, adjusting, and balancing for mechanical systems to meet design specifications.

B. Quality Assurance

- 1. Compliance: Associated Air Balance Council (AABC) requirements; National Environmental Balancing Bureau (NEBB) requirements.

B. Products

1. Systems for Testing:
 - a. Supply air systems; all pressure ranges, including variable volume systems.
 - b. Return air systems.
 - c. Exhaust air systems.
 - d. Hydronic systems.
 - e. Chillers and pumps.
 - f. Cooling towers and pumps.
 - g. Temperature control system.
 - h. Fume hoods.

DIVISION 16 - ELECTRICAL

Section 16000 - Electrical Systems Descriptions

A. Project Includes

1. Electrical Systems for the Following Applications: Refer to individual Specification Sections following for detailed requirements.
 - a. Power and distribution.
 - b. Lighting, including exit and emergency lighting.
 - c. Emergency and standby power systems.
 - d. Fire alarm and life safety.
 - e. Intrusion detection and access control system.
 - f. Telecommunications system provisions.
 - g. Computer/local area network.
 - h. Cable television provisions.
 - i. Empty conduit system.
 - j. Power connections for HVAC and plumbing equipment.
 - k. Power connections for specialty equipment.
 - l. Modifications to and demolition of existing systems.
2. Preliminary Connected Loads:
 - a. Internal Operations Lighting: 150 kVA.
 - b. Convenience Power: 220 kVA.
 - c. User Equipment: 40 kVA.
 - d. Mechanical and Plumbing Equipment: 370 kVA.
 - e. Elevators: 60 kVA.
 - f. Miscellaneous motors: 20 kVA.
 - g. Future growth: 150 kVA.
 - h. Emergency Generator System: 125 kW for life safety and egress lighting, critical ventilation equipment, monitoring and control equipment, critical computer systems, specimen and ultra freezers, UPS systems supporting main computer power and Coast Watch computer servers, backup cooling for main computer room, satellite communications equipment, and critical alarms.
3. Illumination Levels:

- a. Laboratories: 322 to 538 lux (lx) [30 to 50 foot-candles (fc)], with higher levels achieved using localized task lighting.
- b. Offices: 538 lx [50 fc], with higher levels achieved using localized task lighting.
- c. Public Areas: 269 lx [25 fc].
- d. Circulation: 162 lx [15 fc].
- e. Toilets: 108 lx [10 fc].
- f. Service Spaces: 108 lx [10 fc].
- g. Covered Parking: 54 lx [5 fc].
4. Additional Requirements: Coordination of electrical utility services with local utility companies (electric power with Hawaiian Electric Company, Inc., telephone service with GTE Hawaiian Tel, and cable television service with Oceanic Cable).

B. Products

1. Systems, products, and standards are listed in individual Specification Sections that follow.

Section 16110 - Raceways, Cable Trays, and Boxes

A. Project Includes

1. Electrical conduit, tubing, surface raceways, wireways, cable trays, boxes, and cabinets for electrical power and signal distribution.

B. Products

1. Wiring Methods:
 - a. Exposed Indoor Wiring: Electrical metallic tubing or rigid nonmetallic conduit 1.83 m [6 ft.] or more above finished floor; galvanized steel conduit below 1.83 m [6 ft.] above finished floor.
 - b. Concealed Indoor Wiring: Electrical metallic tubing, type MC cable for dry locations. Galvanized steel conduit or rigid nonmetallic conduit in concrete walls.
 - c. Exposed Outdoor Wiring: Rigid steel or nonmetallic (Schedule 80 below 1.83 m [6 ft.] above finish grade or floor) conduit.
 - d. Concealed Outdoor Wiring: Rigid nonmetallic conduit.
 - e. Underground Wiring, Single Run: Rigid nonmetallic conduit.
 - f. Underground Wiring, Grouped: Rigid nonmetallic conduit.
 - g. Connection to Vibrating Equipment: Flexible Metal conduit, liquidtight at exterior.
2. Metal Conduit and Tubing:
 - a. Rigid Steel Conduit: ANSI C80.1.

- b. PVC Externally Coated Rigid Steel Conduit and Fittings: ANSI C80.1 and NEMA RN 1.
- c. Electrical Metallic Tubing (EMT) and Fittings: ANSI C80.3.
- d. Flexible Metal Conduit: UL 1 zinc-coated steel.
- e. Liquidtight Flexible Metal Conduit and Fittings: UL 360.
- 3. Nonmetallic Conduit and Ducts:
 - a. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.
 - b. PVC Plastic Utilities Duct Fittings: NEMA TC 9.
- 4. Raceway Accessory Materials:
 - a. Conduit Bodies: NEC requirements.
 - b. Wireways: NEC requirements.
 - c. Surface Raceways, Nonmetallic: Rigid PVC, UL 94.
- 5. Cable Trays:
 - a. Materials: NEMA FG-1, fiberglass meeting ASTM E-84, maximum 25 flame spread (Class 1 rating).
 - b. Configuration: Ladder or solid-bottom type.
- 6. Boxes and Fittings:
 - a. Cabinet Boxes: UL 50, sheet steel, NEMA 1.
 - b. Pull and Junction Boxes: UL 50, steel boxes.
 - c. Metal Outlet, Device and Small Wiring Boxes: UL 514A and OS 1.
 - d. Nonmetallic Outlet, Device and Small Wiring Boxes: NEMA OS 2.

Section 16119 - Underground Ducts and Utility Structures

- A. Project Includes
 - 1. Underground conduits and ducts, duct banks, pull boxes and handholes, manholes, transformer pad, and other underground utility structures.
- B. Products
 - 1. Underground Duct Applications:
 - a. Electrical Utility Service: Rigid nonmetallic conduit encased in concrete.
 - b. Electrical Feeders: Rigid nonmetallic conduit.
 - c. Electrical Branch Circuits: Rigid nonmetallic conduit.
 - d. Telephone Utility Service: Rigid nonmetallic conduit.

- e. Communication Circuits: Rigid nonmetallic conduit.
- 2. Conduit and Duct:
 - a. Rigid Steel Conduit: ANSI C80.1, galvanized.
 - b. Rigid Nonmetallic Conduit (RNC): NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.
 - c. PVC Plastic Utilities Duct Fittings: NEMA TC 9.
 - d. Plastic-coated Rigid Steel Conduit and Fittings: NEMA RN 1.
- 3. Pull Boxes and Handholes
 - a. Fiberglass Handholes: Molded fiberglass; weatherproof cover with nonskid finish.
- 4. Precast Concrete Utility Structures:
 - a. Precast Units: Interlocking, mating sections.
 - b. Structural Design and Fabrication: ASTM C 858.
 - c. Structural Design Loading: ASTM C 857, class as applicable.
- 5. Accessories:
 - a. Duct Supports: Rigid PVC.
 - b. Frames and Covers: Cast-iron with cast-in legend.
 - c. Sump Frame and Grate: FS RR-F-621, Type VII for frame and Type I for cover.
 - d. Components: Pulling eyes in walls, pulling and lifting irons in floor; cable stanchions, arms and cable support insulators, and ladder.
- 6. Concrete: In accordance with Division 3.

Section 16120 - Wires and Cables

- A. Project Includes
 - 1. Wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volt and less.
- B. Quality Assurance
 - 1. Compliance: National Electrical Code; UL 4, 83, 486A, 486B, 854; NEMA/ICEA WC-5, WC-7, WC-8; IEEE 82.
- C. Products
 - 1. Wire Components:
 - a. Conductors for Power and Lighting Circuits: Solid conductors for 2.588 mm [No. 10] AWG and smaller; stranded conductors for 3.264 mm [No. 8] AWG and larger.
 - b. Conductor Material: Copper.

- c. Insulation: THHN/THWN for conductors size 500 kcmil and larger and 3.264 mm [No. 8] AWG and smaller; THW, THHN/THWN or XHHW insulation for other sizes based on location. Ground conductor may be type TW.
- d. Jackets: Factory-applied nylon or PVC.
- 2. Cables:
 - a. Metal-clad Cable in Cable Trays and Gypsum Board Partitions: UL Type MC.
 - b. Underground Service Entrance Cable: UL Type USE.
 - c. Portable Cord for Flexible Pendant Leads to Outlets and Equipment: UL Type S.
 - d. Control/Signal Transmission Media: Single-conductor coaxial type with polyethylene core; twisted pair, direct burial, aerial, plenum, and video types.
 - e. Fiber Optic Cables: Single-channel, low-loss glass type; plenum type; fiber optic multimode graded-index cables, including connectors, couples, transmitters, receivers, sources, and detectors.
- 3. Connectors: UL-listed, solderless metal connectors with appropriate temperature ratings.

Section 16140 - Wiring Devices

- A. Project Includes
 - 1. Wiring devices for electrical service.
- B. Quality Assurance
 - 1. Compliance: National Electrical Code, NEMA WD 1, UL.
- C. Products
 - 1. Wiring Devices and Components:
 - a. Receptacles: UL 498 and NEMA WD 1, specification grade. Receptacles in laboratories shall be "marine-grade" with nylon bodies and nickel-plated brass metal parts.
 - b. Industrial Receptacles: UL 498 pin and sleeve type; UL 1010 at hazardous locations.
 - c. Ground-Fault Interrupter (GFI) Receptacles: Feed-through type ground-fault circuit interrupter with integral duplex receptacles.
 - d. Plugs: 15 amperes, 125 volts, 3-wire, grounding, armored cap plugs.
 - e. Plug Connectors: 15 amperes, 125 volts, bakelite-body armored connectors, 3-wire, grounding with cord clamp.
 - f. Snap Switches: UL 20 and NEMA WD 1, AC switches, specification grade.
 - g. Combination Switch and Receptacles: Three-way switch, 20 amperes, AC with toggle switch handle, 3-wire grounding receptacle, 15 amperes, 120 volts.

- h. Dimmer Switches, Incandescent Lamps: NEMA WD 1, solid-state modular dimmer switches, 120 volts, 60 Hz, adjustable slide or rotary knob with “off” position.
- i. Dimmer Switches, Fluorescent Lamps: Full-wave modular type AC dimmer with electromagnetic filters, adjustable slide or rotary knob with “off” position.
- j. Wall Plates: Single and combination types, smooth urea or phenolic. Receptacles in wet locations shall be specification grade and installed with a hinged cover/enclosure marked “Suitable for Wet Locations While In Use” and “UL Listed.” Gasketing will be provided between the enclosure and mounting surface and between the hinged cover and mounting plate/base. TAYMAC of Tempe, Arizona, USA.
- k. Poke-through Assembly Devices: Device with above-floor service outlets, multi-channelled through-floor raceway firestop assembly and below-floor junction box assembly.
- l. Telephone/Power Service Poles: Combination telephone and power poles with ceiling and floor trim.

Section 16400 - Service and Distribution

A. Project Includes

- 1. Electrical service and distribution including service entrance, switchboards, low-voltage power switchgear, grounding, transformers, busways, panelboards, and overcurrent protective devices.
- 2. Service and Distribution Requirements: Power shall be distributed through a simple radial system. Service will be provided by Hawaiian Electric Company at 480/277 volts, 3-phase, 4-wire.

B. Products

- 1. Service Entrance:
 - a. Circuit Breakers: Molded case circuit breakers.
 - b. Incoming and Meter Switchboard Section: Acceptable to Hawaiian Electric Company (HECo). UL-approved. Shall meet the requirements of the Electric Utility Service Equipment Requirements Committee (EUSERC) and HECo’s Electric Service Installation Manual.
- 2. Switchboards:
 - a. Switchboard Type: Front-connected, front-accessible with panel-mounted main device, panel-mounted branches, and sections rear aligned.
 - b. Enclosure: NEMA 1, indoor.
 - c. Utility Metering Compartment: As noted above, hot sequence.
 - d. Buses and Connections: Three-phase, 4-wire type, uniform capacity entire length of switchboard. Silver-plated copper busses.

- e. Overcurrent Protective Devices (OCPDs): Ratings, characteristics, and settings suitable for use.
 - f. Circuit Control and Protective Devices: Combination motor starter, automatic transfer switches, and surge arrestors.
 - g. Instrument Transformers: NEMA EI 21.1, IEEE C57.13.
 - h. Ratings: Nominal system voltage, continuous main bus amperage, short-circuit-current rating suitable for use.
4. Grounding:
- a. Grounding Equipment: UL 467; copper conductors; NEC Chapter 9, Table 8 wire and cable conductors; connectors.
 - b. Grounding Electrodes: Copper-clad steel ground rods; copper plate electrodes.
5. Transformers:
- a. Dry Type Transformers: NEMA ST 20, copper windings, two-winding type; enclosure type, insulation class, insulation temperature rise suitable for use; low-voltage surge arrestors; electrostatic shielding, K-rated.
 - b. Drive Isolation Transformers: NEMA ST 1, UL 506, two-winding dry type; continuous duty rating; enclosure type, insulation class suitable for use.
 - c. Buck-Boost Transformers: NEMA ST 1, UL 506, self-cooled dry type; continuous duty rating.
 - d. Control and Signal Transformers: NEMA ST 1, UL 506, self-cooled, two-winding dry type; continuous duty rating.
 - e. Voltage Regulating Transformers: ANSI/IEEE C57.15, ventilated, self-cooled electronic tap-switching unit with no moving parts.
 - f. Voltage Stabilizing Transformers: NEMA ST 1, UL 506, dry-type, self-cooled ferroresonant transformer assembly with no moving parts, stabilizing output voltage within 1 percent of initial value.
 - g. Induction Type Voltage Regulator: ANSI/IEEE C57.15, solid state type with external voltage adjustment, voltage regulation within 1 percent.
6. Busways:
- a. Busways: General purpose plug-in type, ANSI/UL 857, NEMA BU 1, enclosed, nonventilated, suitable for indoor installation, copper conductors.
 - b. Plug-in Devices: Circuit breaker plugs, fusible switch plugs, fuse plugs, combination starter plugs; compatible with connected busway.
7. Panelboards:
- a. Panelboards: NEMA PB 1, UL 50, 61, with bolt-on overcurrent protective devices, enclosure suitable for use, copper bus, bolt-on type main and neutral lugs, IEEE C62.1 surge arrestors.

- b. Panelboard Type: Lighting and appliance branch circuit panelboards; distribution panelboards.
- 8. Overcurrent Protective Devices:
 - a. Overcurrent Protective Devices: Integral to panelboards, switchboards, and motor control centers.
 - b. Cartridge Fuses: NEMA FU 1, class suitable for use.
 - c. Fusible Switches: UL 98, NEMA KS 1, rating suitable for use.
 - d. Molded Case Circuit Breakers: UL 489, NEMA AB 1; combination circuit breaker and ground fault circuit interrupters type; current-limiting circuit breaker type; integrally fused circuit breaker type; solid-state trip device circuit breaker type; rating suitable for use.
 - e. Insulated Case Circuit Breakers: UL 489, NEMA AB 1; rating suitable for use.
- 9. Fuses:
 - a. Cartridge Fuses: ANSI/IEEE FU 1, nonrenewable cartridge type, noninterchangeable type.
 - b. Spare Fuse Cabinet: Wall-mounted 1.2-mm [18-gage] steel unit.

Section 16482 - Motor Control Centers

A. Project Includes

- 1. Motor control center for use on AC circuits rated 600 volts or less.

B. Products

- 1. Motor Control Center (MCC) Components:
 - a. MCC Features: Modular motor controllers, fusible or motor circuit protection, control devices, overcurrent protective devices, transformers, panelboards, instruments, indicating panels, blank panels and accessory items mounted in MCC compartment.
 - b. MCC Wiring Classification: Class II, Type B, NEMA ICS 2.
 - c. MCC Enclosure: NEMA Type I.
 - d. Buses: Plated copper, ampacity rating as applicable to main buses

Section 16515 - Interior Lighting

A. Project Includes

- 1. Interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

B. Quality Assurance

- 1. Compliance: NFPA 70 "National Electrical Code."

C. Products

1. Interior Lighting Components:
 - a. Fluorescent Fixtures: Fixtures, UL 1570; ballasts, UL 935, energy-saving, electronic, and dimming types; air handling (return air) fixtures.
 - b. High Intensity Discharge (HID) Fixtures: UL 1572; ballasts, UL 1029; instant restrike device.
 - c. Incandescent Fixtures: UL 1571.
 - d. Fixtures for Hazardous Locations: UL 844.
 - e. Track Lighting Systems: UL 1574.
 - f. Exit Signs: UL 924, two circuit type.
 - g. Emergency Lighting Units: UL 924.
 - h. Emergency Fluorescent Power Supply: UL 924.
 - i. Lamps: ANSI Standards, C78 series.
 - j. Suspended Fixture Support Components: Stem, rod, and hook hangers.

Section 16525 - Exterior Lighting

A. Project Includes

1. Exterior lighting fixtures, lamps, ballasts, poles, standards, and accessories.

B. Quality Assurance

1. Compliance: NFPA 70 "National Electrical Code."

C. Products

1. Exterior Lighting Components:
 - a. Fluorescent Fixtures: Fixtures, UL 1570; ballasts, UL 935, energy-saving and electronic types.
 - b. High Intensity Discharge (HID) Fixtures: UL 1572; ballasts, UL 1029; instant restrike device.
 - c. Incandescent Fixtures: UL 1571.
 - d. Lamps: ANSI Standards, C 78 series.
 - e. Fixture Support Poles, Mast Arms and Brackets: Aluminum, suitable for 129 kph [80 mph] wind factor with 1.3 gust factor.

Section 16610 - Uninterruptible Power Supply Systems

A. Project Includes

1. Uninterruptible power supply system for the main computer and Coast Watch server rooms.
- B. Quality Assurance
 1. Compliance: UL 1778.
- C. Products
 1. Uninterruptible Power Supply System Components:
 - a. Type: Three-phase, on-line, static-type, nonredundant UPS.
 - b. Service Conditions: Suitable for location.
 - c. Rectifiers/Battery Charger: Adequate to supply inverter during full output load conditions and simultaneous recharge.
 - d. Battery: Valve-regulated, recombinant, lead-calcium type.
 - e. Battery Monitoring System: Ground-fault detector alarm, smoke/high-temperature alarm, automatic measurement and recording.
 - f. Inverter: Pulse-width modulated.
 - g. Static Bypass Switch: Continuous-duty at rated full load.
 - h. Maintenance Bypass Isolation Switch: Continuous-duty at rated full load.
 - i. Panelboard, Indication and Control: Suitable for use.
 - j. Remote Control and Monitoring: Computerized remote system.

Section 16620 - Packaged Engine Generator Systems

- A. Project Includes
 1. Packaged diesel engine generator system.
- B. Quality Assurance
 1. Compliance: NFPA 110.
- C. Products
 1. Packaged Engine Generator System Characteristics:
 - a. Type: Standby-rated automatically started diesel engine coupled to an AC generator unit.
 - b. Ratings: Voltage, frequency, and power output ratings suitable for use.
 - c. Maximum Transfer Time to Assume Full Load: Suitable for service.
 - d. Fuel Supply: Forty-eight hours of operation.
 2. Packaged Engine Generator System Components:
 - a. Engine: NFPA 37.

- b. Engine Fuel: Diesel fuel oil grade DF-2.
- c. Cooling System: Closed-loop, liquid-cooled, radiator mounted on generator set base.
- d. Fuel Supply System: NFPA 30, 37; day tank, redundant high-level fuel shutoff, fuel piping and storage tank.
- e. Engine Exhaust System: Muffler type, critical, suitable for use.
- f. Combustion Air-intake System: Filter type air intake silencer, intake duct, and connections.
- g. Starting System: Electric with negative ground.
- h. Control and Monitoring: Operating and safety indications, protective devices, basic system controls, and engine gages.
- i. Generator, Exciter, and Voltage Regulator: NEMA MG 1, direct drive.
- j. Transfer Switches: Automatic 4-pole, applicable to service required.

Section 16660 - Ground-fault Protection Systems

A. Project Includes

- 1. Ground-fault sensing, relaying, tripping, and alarm devices for installation in distribution switchboards and panelboards rated 600 volts and less.

B. Products

- 1. Ground-fault Sensing Devices:
 - a. Outgoing-circuit Current Sensors: Current transformer with circuits requiring outgoing-circuit sensing method.
 - b. Ground-return Current Sensors: Current transformer for encircling main bonding jumper connection.
 - c. Short Circuit Rating: 200,000 amperes RMS symmetrical.
 - d. Outputs: Compatible with relay inputs.
- 2. Ground-fault Relays and Monitors:
 - a. Ground-fault Relay: Solid-state type without external electrical power supply required for relay.
 - b. Monitor Panels: Ground-fault indicators, control-power indicators, test and reset buttons.

Section 16721 - Fire Alarm Systems

A. Project Includes

1. Zoned, noncoded, addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation, analog addressable smoke detectors, and automatic alarm verification for alarms initiated by designated smoke detector zones.
- B. Quality Assurance
1. Compliance: NFPA 70 and 72 and the Fire Code of the City and County of Honolulu.
- C. Products
1. Fire Alarm System Characteristics:
 - a. Signal Transmission: Dedicated multiplex signal transmission.
 - b. Audible Alarm Indication: Tone signals on loudspeakers, and voice alarm messages.
 - c. Interface: Smoke removal systems, smoke dampers, air handling units control.
 2. Fire Alarm System Components:
 - a. Manual Pull Stations: Double-action type, metal or plastic, break glass type.
 - b. Smoke Detectors: UL 268, self-restoring type with visual indicator, photoelectric type.
 - c. Thermal Detectors: Fixed-temperature and rate-of-rise type.
 - d. Visual Alarm Devices: Dual-voltage strobe lights.
 - e. Voice/Tone Speakers: UL 1480 type.
 - f. Fire Fighters Telephones: Telephone handset with dedicated, supervised communication lines.
 - g. Device Location-indicating Lights: System-voltage-indicating light.
 - h. Magnetic Door Holders: Wall- or floor-mounted type.
 - i. Fire Alarm Control Panel: UL 864 with lockable steel enclosure; with alphanumeric display and system controls.
 - j. Graphic Annunciator: LED indicators on graphic building floor plan.
 - k. System Printer: Dot-matrix type.
 - l. Transmitter: Auto-dialer type.
 - m. Emergency Power Supply: Battery-operated, 24-hour-operation capacity.
 - n. Line-voltage and Low-voltage Circuits: Solid copper conductors with rated insulation, color coded.
 - o. Conduit: As noted in Section 16110.

Section 16724 - Intrusion Detection Systems

- A. Project Includes
1. Intrusion detection system including sensors, signal equipment, controls, and alarm displays.

B. Quality Assurance

1. Compliance: UL 609, 681, 1023, 1076, 1641, FM approval as applicable.

C. Products

1. Intrusion Detection System Components:
 - a. Surge Protection: UL 1449.
 - b. Interference Resistance: Not affected by radiated radio frequency interference and electrical as applicable.
 - c. Tamper Protection: Tamper protection switches.
 - d. Intrusion Detection Devices: Types, features, accessories and mounting conditions as applicable.
 - e. Alarm Contact Arrangement: Single-pole, double-throw type.
 - f. Door Switches: UL 634.
 - g. Space Intrusion Detection Devices: UL 639, passive infrared, microwave, acoustical, glass-break, vibration, and dual-technology devices as applicable.
 - h. System Control Panel: UL compliance for type of unit.
 - i. Annunciator: Visual display and audible alarm.
 - j. Secure-Access Control Stations: Keypad, display module, and key-operated switch.
 - k. System Printer: Dot-matrix type with NRTL label.
 - l. Wire and Cable: Stranded copper.

Section 16740 - Telecommunications (Voice and Data) Systems

A. Project Includes

1. Interior telecommunications distribution system.
2. System Requirements: Coordination of electrical service with GTE Hawaiian Tel and Oceanic Cable. Thirty-six line capacity with 24 lines initially.

B. Quality Assurance

1. Compliance: FED STD 1090, ANSI/EIA 568, and ANSI X3T9 FDDI.

C. Products

1. Telecommunication System Components:
 - a. Telecommunications wiring, backboards with patch panels, and jacks.
2. Telecommunications Distribution System Components:
 - a. Terminal Blocks: Type 66 or 100, stand-off brackets.

- b. Jack Assemblies: Eight-position modular, latching, plug type angled at 45 degrees away from wall.
- c. Cable: 4 pair, No. 24 AWG, solid copper, plenum cable. Category 3 cable for voice, Category 5 and multimode fiber cable with four fiber strands for data.
- d. Cable Trays, Raceways, Boxes, Cabinets: Comply with project standards.
- e. Backboard: Interior grade plywood, 19 mm [0.75 in.] thick, painted with white fire-retardant paint.

Section 16780 - Television Systems

A. Project Includes

- 1. Empty conduit with pullstring for video conferencing capability; master antenna television system (MATV) for single-source distribution to distributed televisions.

B. Products

- 1. MATV System Components:
 - a. Raceways and outlet boxes per Project standards.

Section 16915 - Lighting Control Equipment

A. Project Includes

- 1. Lighting Control Equipment: Occupancy sensor.

B. Products

- 1. Lighting Control Equipment Components:
 - a. Dimmers: UL 508.
 - b. Contactors and Relays: NEMA ICS 2, electrically operated and mechanically held devices; pilot lights.
 - c. Time Switches and Sensors: Solid-state type time switches, UL 917. UL 773A photoelectric relays, solid state, with SPDT dry contacts for relay or contactor control, with time delay to prevent false operation.
 - d. Occupancy Sensors: UL listed, Class 2, ultrasonic, ceiling-mounted, motion-detection type, with sensing head.

End of Outline Specification